Journal of Personality and Social Psychology
1999, Vol. 77, No. 4, 762–773

0022-3514/99/$3.00

Locomotion in Social Dilemmas: How People Adapt to Cooperative, Tit-for-Tat, and Noncooperative Partners

Paul A. M. Van Lange and Kitty Visser
Free University, Amsterdam

The authors address locomotion in social dilemmas, examining the influence of social value orientation (prosocial, individualistic, and competitive orientations) and partner's strategy (100% cooperation, tit for tat, and 100% noncooperation) on cooperative behavior and locomotion to enhanced or reduced levels of interdependence (tendencies toward approach vs. avoidance). Extending prior research on behavioral assimilation (e.g., H. H. Kelley & A. J. Stahelski, 1970), results revealed that a noncooperative partner elicited not only relatively low levels of cooperation but also locomotions to low interdependence. Also, relative to prosocials and individualists, competitors exhibited low levels of cooperation and locomotions to low interdependence with a tit-for-tat partner. This underscores the functionality of tit for tat, in that it moves away those who seek relative advantage, thus minimizing the costs following from noncooperative interactions.

Generally, interactions tend to be pleasant with others who take our interests into account and behave in a cooperative manner. However, every now and then, one interacts with others who pursue their self-interest at the expense of one's own interest and the collective interest. How do people respond to others who act in a selfish or noncooperative manner? Are they likely to act selfishly in turn? Are they likely to move away from this other, thereby seeking to become less dependent on this other person? Or both?

Although there are more than two routes that one can take, the large literature of cooperation and competition suggests the former answer. Even if individuals are quite generous and considerate themselves, they are likely to "behaviorally assimilate" or "reciprocate" noncooperative behavior, especially if the other repeatedly engages in noncooperative behavior (e.g., Kelley & Stahelski, 1970; Komorita, Hilty, & Parks, 1991). Clearly, behavioral assimilation and reciprocity are important phenomena, providing a plausible explanation for interaction patterns that are often labeled as *mutual noncooperation, DD lock-in effects,* and *escalation of conflict* (e.g., Komorita & Parks, 1995; Pruitt & Kimmel, 1977).

At the same time, we suggest that tendencies toward behavioral assimilation and reciprocity provide only part of the answer. In many situations, individuals are not slaves to their circumstances but are able to alter the situation in ways that allow them to pursue their goals in a more effective manner. Indeed, the second answer is also quite plausible. One might, in fact, seek to move away from noncooperative others, thereby becoming less dependent on the other's actions (and frequently, with the other becoming less dependent on one's actions). One might assume that social interactions in everyday life are often guided by movement to varying levels of interdependence. For example, people are likely to appreciate and seek out joint activities with others with whom they have had pleasant interaction experiences; yet they may seek to avoid those with whom they have had less pleasant interaction experiences. Presumably, interactions with close partners, friends, colleagues, neighbors, and business partners are shaped by such behaviors. Although it is often very difficult to become entirely independent of such others (e.g., a colleague or neighbor cannot be completely avoided, unless one moves to a different job or place), people often do have an option to vary the level of interdependence with such others. Examples are the degree to which one engages in joint activities, such as collaborative projects or social events, or the degree of attention and interest one conveys with respect to interacting with others. Notably, behaviors that are linked to interpersonal approach versus avoidance have received very little attention in the literature of cooperation and competition. Indeed, this literature has focused primarily on the determinants of cooperative and competitive behavior within one particular situation, in the absence of possibilities to change features of that situation.

Locomotion

Behavior through which actors change features of a situation may be referred to as *locomotion.* More specifically, *locomotion* may be defined as goal-directed activity causing change in the interdependence structure underlying an interaction situation (or patterns of interaction situations) involving two or more individuals. This definition is based on Lewin's (1935) original definition

Paul A. M. Van Lange and Kitty Visser, Department of Social Psychology, Free University, Amsterdam, the Netherlands.

This research was supported by Netherlands Organization of Scientific Research Grant R-57-178.

A portion of this research was presented at the 1995 SESP/EAESP joint meeting in Washington, DC and at the Sixth International Conference on Social Dilemmas, Wassenaar, the Netherlands, July 1995. We thank Johan Karremans, Norbert Kerr, Jaap Ouwerkerk, and Mirjam Tazelaar for their helpful comments on an earlier version of this article; Curt Camac for discussing his ideas regarding experimental procedures; and Gooitske Marsman for her help in computerizing the experimental procedures.

Correspondence concerning this article should be addressed to Paul A. M. Van Lange, Department of Social Psychology, Free University, Amsterdam, Van Der Boechorststraat 1, 1081 BT Amsterdam, the Netherlands. Electronic mail may be sent to pam.van.lange@psy.vu.nl.

of *locomotion* and on subsequent definitions of *locomotion*, which stress "goal-directed activity" and "sequence of actions" (Cartwright & Zander, 1953, pp. 401–402), as well as on more contemporary theory of interdependence and transition lists (Kelley, 1984, 1997; Kelley & Thibaut, 1978). In the current definition, *goal-directed activity* involves one action (or a sequence of actions) by one or multiple individuals, which unilaterally or jointly determines features of situations to which one or multiple individuals move (cf. Cartwright & Zander, 1953). The concept of *interdependence structure* may involve fundamental properties of interdependence (e.g., degree and mutuality of dependence, the degree to which outcomes conflict vs. correspond; Kelley & Thibaut, 1978) as well as differences in the sequence and timing of future actions (e.g., the decision to make a preemptive move, the decision to delay future interaction situations; cf. Kelley, 1984, 1997; Van Lange, 1994).

Locomotion is a useful concept because it emphasizes not only change or movement from one situation (or location) to another but also the distinction between means and ends, thus focusing on the interpersonal routes one can take in relation to the goals one seeks to accomplish (cf. paths and forces; Lewin, 1935, 1936/1966). Our focus on locomotion is also importantly inspired by Kelley's (1984, 1997) transition list approach to interdependence, which seeks to overcome the "static" use of outcome matrices by providing a conceptual framework for bringing to researchers' attention not only outcome-relevant actions but also actions that bring the individual, the dyad, or the larger group to new situations. By virtue of locomotions or transitions from one situation to another, this analysis helps conceptualize a broader behavioral repertoire within the interdependence framework, including not only cooperative and competitive tendencies but also other interaction-relevant tendencies, such as dominance versus submission, activity versus passivity, and approach versus avoidance (cf. Van Lange, 1997). Such tendencies are in fact part of how individuals tend to evaluate the self and others as interdependent actors (e.g., evaluation, potency, and activity; Osgood, Suci, & Tannenbaum, 1957; circumplex models; cf. Wiggins, 1979).

There are at least two complementary reasons that locomotion is important. First, locomotion calls attention to how individuals' goals and motivations are reflected in situation selection, thereby complementing extant research and theory that tend to focus on how situations affect responses (such as cooperation and competition) rather than actions aimed at changing features of a situation (see also Snyder & Ickes, 1985). Second, research using the outcome matrix (e.g., the prisoner's dilemma) has been criticized primarily for its limited ecological validity, a limitation that, at least partially, derives from the static use of outcome matrices (cf. Nemeth, 1972; Pruitt & Kimmel, 1977). As noted earlier, interdependent actors in real life are often provided with a broader behavioral repertoire, including actions aimed at approaching or avoiding particular others. Accordingly, extending the behavioral repertoire potentially serves the degree to which one captures behaviors that are relevant to understanding social interaction in real life, thus providing an enhanced basis for strengthening the ecological validity of the experimental game and related methodology. For example, preferences for structural change in social dilemmas (cf. Messick et al., 1983; Samuelson, Messick, Rutte, & Wilke, 1984; Van Vugt, 1997), withdrawal choices in prisoner's dilemmas (e.g., Miller & Holmes, 1975; Schopler & Insko, 1992; Yamagishi, 1988), selection of alternative partners (Dawes & Orbell, 1992; Yamagishi, Hayashi, & Jin, 1994), or exclusion of particular others in small groups (Kerr, in press) can be viewed in terms of locomotion (i.e., such choices cause change in the interdependence underlying an interaction situation) and help enhance the ecological validity of the experimental gaming paradigm.

The Present Research

The present study used an iterated social dilemma task, characterized by the conflict between the pursuit of personal well-being versus collective well-being. Using a new paradigm, the present research addresses outcome-relevant behavior (i.e., cooperation vs. noncooperation) and locomotion to varying levels of interdependence underlying social dilemmas. Locomotion was assessed by examining participants' choices among one of five social dilemmas that systematically differed in levels of *fate control* (i.e., unilateral control of partner's actions on one's own outcomes) relative to *reflexive control* (i.e., unilateral control of an individual's actions on one's own outcomes).[1]

The major purpose of the present research was threefold. First, we examined individuals' cooperation and locomotions to varying levels of interdependence in response to three classic strategies pursued by the partner: (a) an unconditionally cooperative strategy, (b) a tit-for-tat strategy (i.e., a conditionally cooperative strategy, which commences a cooperative choice and subsequently imitates the previous choice of the partner), and (c) an unconditionally noncooperative strategy. We also examined the effects of partner's locomotions, manipulating the degree to which the partner moved to high versus low levels of interdependence. Second, we examined whether and how individuals' own interaction goals (i.e., prosocial, individualistic, or competitive orientations) affected their choices and locomotions in response to a cooperative partner, a tit-for-tat partner, and a noncooperative partner. Third, we examined the functioning of participants and the collective, assessing the quality of outcomes the participant obtained (i.e., participant's outcomes) and the dyad obtained (i.e., collective outcomes) across interactions.

The Role of Partner's Strategy in Static Social Dilemmas

A long tradition of research has revealed that cooperation is importantly shaped by the strategy pursued by the interdependent partner. The consistent finding is that the tit-for-tat strategy elicits greater cooperation than an unconditionally cooperative strategy (i.e., 100% cooperation), which in turn elicits greater cooperation than an unconditionally noncooperative strategy (100% noncoop-

[1] Our choice to study locomotion in the realm of reducing versus enhancing interdependence was further guided by two broad considerations. First, dependence—and in its mutual form, interdependence—is one of the primary features of the taxonomy of situations provided by interdependence theory (Kelley & Thibaut, 1978). Second, locomotion regarding the degree of interdependence does capture tendencies toward approach and avoidance, which were given a central meaning in classic theories of group dynamics and personality development (e.g., attachment theory, social learning theory).

eration; for a classic review, see Oskamp, 1971). Moreover, Axelrod's (1984) tournament studies as well as more recent research (e.g., Komorita et al., 1991) provide strong evidence in support of the claim that tit for tat is among the most effective strategies in eliciting cooperation.

Does tit for tat elicit cooperation among all individuals? Research of Kuhlman and Marshello (1975) examined simultaneously the role of the strategy pursued by the partner and individuals' social value orientation. Specifically, they examined differences among three types of social value orientation: (a) *prosocial* orientation (i.e., maximization of outcomes for both self and others and minimization of differences between outcomes for self and others), (b) *individualistic* orientation (i.e., maximization of one's own outcomes with little or no regard for outcomes for others), and (c) *competitive* orientation (i.e., maximization of relative advantage over others; these definitions are based on evidence reported in Van Lange, 1999). Kuhlman and Marshello were able to demonstrate that (a) prosocials exhibited cooperation with cooperative and tit-for-tat partners yet turned to noncooperation with noncooperative partners; (b) individualists exhibited high cooperation with partners pursuing tit for tat, substantially lower cooperation with cooperative partners, and no cooperation with noncooperative partners; and (c) competitors did not exhibit cooperation with any of these interaction partners (for related evidence, see McClintock & Liebrand, 1988; Sattler & Kerr, 1991). Such evidence suggests that the effectiveness of tit-for-tat can be understood because it allows for (a) the pursuit of collective outcomes and desire for equality of outcomes, thereby motivating prosocials to cooperate, and (b) the pursuit of long-term personal outcomes, thereby motivating individualists to cooperate. The general absence of cooperative behavior among competitors can be understood because relative advantage over the partner's outcomes cannot be served by engaging in cooperative behavior.

From Static Social Dilemmas to Locomotion in Social Dilemmas

The findings by Kuhlman and Marshello (1975) rely on relatively static social dilemmas, in which both the individual and the partner can pursue their interaction goals only through making cooperative or noncooperative choices. What are the psychological implications of a more dynamic situation in which both the individual and the partner can also locomote to reduced versus enhanced levels of interdependence? We outline two implications. The first implication derives from the partner's ability to move to reduced versus enhanced levels of interdependence. The second implication derives from the individual's ability to move to reduced versus enhanced levels of interdependence.

First, the static social dilemma is characterized by outcome control, through which individuals provide good or bad outcomes for the partner. A more dynamic social dilemma, as studied presently, is also characterized by locomotion, allowing the partner (and the individual himself or herself) to determine the level of interdependence underlying future interaction situations. The combination of outcome control (through cooperative and noncooperative choices) and locomotion (through movement to varying levels of interdependence) provides a partner with a fair amount of power over the individual (and vice versa; cf. Thibaut & Kelley, 1959). Locomotion to high (versus low) interdependence increases the impact a partner has on an individual's outcomes, with cooperative choices yielding very good outcomes for the individual and noncooperative choices yielding very bad outcomes for the individual. Thus, the partner's availability to move the individual (along with the partner himself or herself) to situations varying in level of interdependence might explain why people who are primarily or exclusively interested in enhancing outcomes for self (i.e., individualists) tend to behave quite cooperatively with a cooperative partner in a more dynamic social dilemma. Competitors do not tend to behave cooperatively in response to cooperative partners (Van Lange, 1994; for a related finding, see Van Lange, Agnew, Harinck, & Steemers, 1997). Thus, we anticipated replicating the findings of Kuhlman and Marshello (1975), with the exception that we expected a cooperative partner to elicit fairly high levels of cooperation in both prosocials and individualists.

Second, the possibility of locomotion to varying levels of interdependence allows for tendencies toward interpersonal approach versus interpersonal avoidance. When individuals can accomplish (or anticipate they can accomplish) their primary interaction goals with an interaction partner (i.e., anticipation of goal success), they should want to move to enhanced levels of interdependence with this partner. For example, if an individual is interested in enhancing joint outcomes and equality in outcomes and the partner's strategy permits the attainment of these interaction goals (e.g., a partner pursuing cooperation or tit for tat), then this individual should wish to move to enhanced levels of interdependence. In contrast, when individuals cannot accomplish (or anticipate they cannot accomplish) their primary interaction goals (i.e., anticipation of goal failure), then they should want to move to reduced levels of interdependence. For example, if an individual is interested in enhancing joint outcomes and equality in outcomes, and the partner's strategy does not permit the attainment of these interaction goals (i.e., the partner is a noncooperative partner), then this individual should wish to move to reduced levels of interdependence.

A Framework for Understanding Cooperation, Locomotion, and Functioning

Table 1 represents a framework that outlines the probable choices (cooperation vs. noncooperation), goal experiences (success vs. failure), and locomotion (to enhance vs. to reduce interdependence), as well as the functioning of the individual himself or herself (i.e., the quality of participant's outcomes) and the joint functioning of the participant and the partner (i.e., the quality of collective outcomes).[2] What hypotheses might be derived from this framework?

[2] It should be clear that anticipation of interaction goal attainment (success vs. failure), as summarized by the concept of goal experience, is an important theoretical construct in our framework (see Table 1). However, we did not include measures to assess goal experiences, because (a) we did not want to interrupt participants' interactions, and (b) we did not want to enhance "awareness" regarding a link between "anticipated goal experiences" and locomotion (or cooperation). Also, given that the design

Table 1
A Framework for Understanding Responses of Prosocials, Individualists, and Competitors to Cooperative, Tit-for-Tat, and Noncooperative Partners

	Partner's choice		
Social value orientation	Cooperation	Tit-for-tat	Noncooperation
Prosocials			
Choice	Cooperation	Cooperation	Noncooperation
Goal experience	Success	Success	Failure
Interdependence	Enhanced	Enhanced	Reduced
Participant's outcomes	Good	Good	Poor
Collective outcomes	Very good	Very good	Very poor
Individualists			
Choice	Cooperation	Cooperation	Noncooperation
Goal experience	Success	Success	Failure
Interdependence	Enhanced	Enhanced	Reduced
Participant's outcomes	Good	Good	Poor
Collective outcomes	Very good	Very good	Very poor
Competitors			
Choice	Noncooperation	Noncooperation	Noncooperation
Goal experience	Success	Failure	Failure
Interdependence	Enhanced	Reduced	Reduced
Participant's outcomes	Very good	Poor	Poor
Collective outcomes	Poor	Very poor	Very poor

With respect to cooperation, we expected a main effect of partner's strategy, such that relative to a noncooperative partner, cooperative and tit-for-tat partners would elicit greater cooperation (Hypothesis 1). Further, although a main effect for social value orientation is plausible (with prosocials and individualists exhibiting greater cooperation overall than competitors), we expected the magnitude of the differences between prosocials and individualists versus competitors to depend on partner's strategy. As can be inferred from Table 1, the more important prediction is that we anticipated the differences between prosocials and individualists versus competitors to be more pronounced for a cooperative partner and a tit-for-tat partner than for a noncooperative partner. Thus, we expected that, relative to competitors, prosocials and individualists would exhibit greater levels of cooperation with a cooperative partner and a tit-for-tat partner, whereas such differences would be less pronounced when interacting with a noncooperative partner (Hypothesis 2).

With respect to locomotion, our framework assumes that individuals tend to locomote to enhanced levels of interdependence if they anticipate accomplishing their primary interaction goals (such as enhancement of joint outcomes along with equality in outcomes, enhancement of own outcomes, and enhancement of relative advantage) and locomote to reduced levels of interdependence if they anticipate not accomplishing their primary interaction goals. Clearly, a noncooperative partner restrains possibilities for enhancing joint outcomes along with equality in outcomes, enhancing outcomes for self, and relative outcomes. These goals can be more successfully attained with a cooperative partner and a tit-for-tat partner (except for pursuing relative outcomes during interaction; see Table 1). Thus, we predicted a main effect of partner's strategy, such that, relative to noncooperative partners, cooperative and tit-for-tat partners would elicit locomotion to greater levels of interdependence; moreover, a cooperative partner is likely to elicit locomotions to somewhat greater levels of interdependence than a tit-for-tat partner (Hypothesis 3).

Further, although a main effect for social value orientation is plausible (with prosocials and individualists exhibiting locomotions to greater levels of interdependence than competitors), we expected the magnitude of the differences between prosocials and individualists versus competitors to depend on partner's strategy. As can be inferred from Table 1, the more important prediction is that we anticipated the differences between prosocials and individualists versus competitors to be more pronounced for a tit-for-tat partner than for a cooperative partner or a noncooperative partner. The reasoning is that prosocials (concerned with joint outcomes and equality in outcomes), individualists (concerned with own outcomes), and competitors (concerned with relative advantage) can accomplish their primary interaction goals when interacting with cooperative partners but cannot accomplish their primary interaction goals when interacting with a noncooperative partner. Thus, for these two partners, differences between prosocial, individualistic, and competitive participants should be small, if present at all. In contrast, when interacting with a tit-for-tat partner, both prosocial and individualistic participants can accomplish their primary interaction goals, but competitive participants cannot (i.e., one cannot effectively accomplish relative advantage with a tit-for-tat partner, because tit for tat imitates the previous choice). Therefore, we expected that, relative to prosocials and individualists, competitors would move to lower levels of interde-

already involves three independent variables, we did not directly compare the present conditions to conditions that do not include a locomotion option. Instead, we compared the present results to the consistent patterns of results obtained in previous research that did not include a locomotion option (e.g., Kuhlman & Marshello, 1975; McClintock & Liebrand, 1988; Sattler & Kerr, 1991).

pendence particularly when interacting with a tit-for-tat partner; such differences should be less pronounced (if present at all) when interacting with a cooperative partner or a noncooperative partner (Hypothesis 4).

With respect to functioning, Table 1 outlines how partner's strategy and individuals' social value orientations should impact participants' functioning (i.e., participant's outcomes) and collective functioning (i.e., collective outcomes). Both types of functioning, as noted earlier, should be determined by both level of cooperation and level of interdependence. A tit-for-tat partner was expected to elicit high levels of cooperation and high levels of interdependence among prosocials and individualists, but low levels of cooperation and low levels of interdependence among competitors. In contrast, when interacting with a noncooperative partner, prosocials, individualists, and competitors were expected to exhibit low levels of cooperation and locomotion to reduced interdependence. When interacting with a cooperative partner, prosocials and individualists were expected to exhibit high levels of cooperation and locomotion to high interdependence (a pattern yielding good outcomes for self and the collective), whereas competitors were expected to exhibit relatively low levels of cooperation and high interdependence (a pattern yielding very good outcomes for self, and fairly good outcomes for the collective, although distributed unequally). Taken together, the primary hypotheses were that, relative to competitors, prosocials and individualists would obtain greater outcomes for self (Hypothesis 5) and greater collective outcomes (Hypothesis 6) when interacting with a tit-for-tat partner, and that such differences between competitors versus prosocials and individualists would be substantially smaller when interacting with a cooperative partner or a noncooperative partner.

As noted earlier, we examined the effects of partner's locomotions to either high or low levels of interdependence. This variable was included because it allows for a situation of symmetry in which both the participant and the partner are able to locomote to different levels of interdependence. Also, although one might advance several specific hypotheses (e.g., partner's locomotions might amplify the effects of partner's strategy, such that cooperative and tit-for-tat partners elicit greater cooperation when moving to high rather than low interdependence, whereas the reverse might be found for noncooperative partners), we advanced no formal hypotheses for this variable.

Method

Participants and Experimental Design

One hundred eighty participants (77 men, 102 women, and 1 participant whose gender was unidentified) with an average age of 23 years took part in this study. They were recruited by means of an advertisement in the university paper. Each participant was paid 15 Dutch Guilders (approximately $8). The experimental design included two between-subjects variables and two within-subject variables. The between-subjects variables were social value orientation (prosocial vs. individualistic vs. competitive) and partner's locomotion (low vs. high interdependence), and the within-subject variables were partner's strategy (cooperative vs. tit for tat vs. noncooperative) and blocks of trials, to be discussed shortly. The primary dependent measures were the number of cooperative choices per block and locomotion to varying levels of interdependence.

Procedure

Six to 8 participants attended each research session. On arrival, each participant was greeted and escorted to one of eight cubicles, preventing participants from communicating with each other. The entire experiment was computerized. At the end of the research session, participants were thanked for their participation, debriefed, and paid.

Measuring social value orientation. Each participant's social value orientation was determined by his or her responses to a series of nine decomposed games, which involve making choices between specific combinations of outcomes for oneself and for a (hypothetical) other (Messick & McClintock, 1968). Outcomes were presented in terms of points, and participants were asked to imagine that the points had value to themselves as well as to the other person. Each decomposed game provided participants with a choice among three alternatives, one corresponding to each of the three social value orientations (for extended instructions regarding the nine-item decomposed game measure, see Van Lange, Otten, De Bruin, & Joireman, 1997). An example is the choice among A: 480 points for self and 80 points for other, B: 540 points for self and 280 points for other, and C: 480 points for self and 480 points for other. In this example, Choice A represents the competitive option, because it yields the largest difference between one's own and the other's outcomes, Choice B represents the individualistic option because it yields the largest outcomes for self, and Choice C represents the prosocial option because it yields the largest joint outcomes and the smallest discrepancy between outcomes for self and the other. As in previous research (e.g., McClintock & Allison, 1989; Van Lange & Kuhlman, 1994), participants were classified into one of the three categories of social value orientation if they made at least six of the nine choices consistent with that category. We identified 66 prosocial participants, 42 individualists, and 33 competitors. Thirty-nine participants made fewer than six consistent choices and were omitted. As in previous research using similar sample sizes (e.g., McClintock & Liebrand, 1988; Van Lange & Kuhlman, 1994), social value orientation was not significantly associated with gender, $\chi^2(2, N = 141) = 2.14$, *ns*.

The experimental task. The instructions for the experimental task began by explaining five different social dilemmas presented as Matrices 1 through 5 in Table 2. The social dilemma features were explained using

Table 2
Five Social Dilemmas Systematically Varying in Level of Interdependence

	Partner's choice			
	Cooperation		Noncooperation	
Participant's choice	Points for self	Points for partner	Points for self	Points for partner
Matrix 1				
Cooperation	2	2	−50	50
Noncooperation	50	−50	−2	−2
Matrix 2				
Cooperation	10	10	−50	50
Noncooperation	50	−50	−10	−10
Matrix 3				
Cooperation	18	18	−50	50
Noncooperation	50	−50	−18	−18
Matrix 4				
Cooperation	26	26	−50	50
Noncooperation	50	−50	−26	−26
Matrix 5				
Cooperation	34	34	−50	50
Noncooperation	50	−50	−34	−34

Matrix 3, representing an average level of interdependence. Individual rationality was illustrated by explaining that "compared to one's own choice for Alternative A, a choice for Alternative B results in a 32-point greater outcome for self, irrespective of the other's choice." Collective rationality was illustrated by stating that "when both you and the other choose A, each of your outcomes will be an 18 point gain; yet, when both you and the other choose B, each of your outcomes will be an 18 point loss." Participants were also told that "the other's choice for Alternative B will always yield losses for self" and that "the other's choice for Alternative A will always yield gains for self."

The differing levels of interdependence underlying the five social dilemmas represent (a) the extent to which the partner's choice of A results in greater outcomes to self than the partner's choice of B, irrespective of one's own choice (i.e., a main effect for partner's choice, or fate control; cf. Kelley & Thibaut, 1978), and (b) the extent to which one's own choice of B results in greater outcomes for self than one's own choice of A, irrespective of the other's choice (i.e., a main effect for own choice, or reflexive control; cf. Kelley & Thibaut, 1978). As can be seen in Table 2, the degree of fate control systematically increases from Matrices 1 to 5 (i.e., fate control was 52, 60, 68, 76, and 84, respectively), whereas the degree of reflexive control systematically decreases from Matrices 1 to 5 (i.e., reflexive control was 48, 40, 32, 24, and 16). Put differently, the impact of partner's choices on an individual's outcomes increased by 8 points per matrix from Matrix 1 to Matrix 5, whereas the impact of an individual's own choices on one's outcomes decreased by 8 points per matrix from Matrix 1 to Matrix 5. Thus, the ratio of reflexive control to fate control systematically varied across the five situations, from 48:52 (or 92.3%) in Situation 1 to 16:84 (or 19.0%) in Situation 5.[3]

Although the experimental task focused on points, we sought to increase the value of points by noting that they would increase the odds of receiving a 25-Guilder book certificate (i.e., a gift certificate for buying books at any bookstore in the Netherlands) as they accumulated a greater number of points. That is, we stated that the number of points accumulated for themselves corresponded to a number of tickets in a raffle for the book certificates, making clear that their chances would increase by the number of points they accumulated for themselves, not by the number of points they accumulated more than others (i.e., we used an absolute standard, and the number of certificates was not fixed). After the experiment, we held a raffle and five 25-Guilder book certificates were awarded. (In the actual raffle, each participant had an equal chance of winning the book certificate, because participants in the condition in which the partner locomoted to high [vs. low] interdependence had a greater chance of accumulating a large number of points.)

A 10-item comprehension check of instructions for the social dilemma task revealed good comprehension (i.e., 9 of 10 questions were correctly answered, on average). However, there were 8 participants (including 6 participants who were classifiable in terms of their dominant social value orientations) who answered fewer than six questions correctly. The data of these participants were discarded, leaving a total of 135 participants, including 65 prosocial individuals, 39 individualists, and 31 competitors.

Manipulation of partner's strategy. A cooperative partner was programmed to make a cooperative choice at each trial, a noncooperative partner was programmed to make a noncooperative choice at each trial, and a tit-for-tat partner was programmed to begin by making a cooperative choice and then to make the choice that the participant had made in the previous trial. The three preprogrammed strategies were administered in six different orders (i.e., examining all possible orders). For both cooperation and locomotion to varying levels of interdependence, we included order in the analyses but found no significant main or interaction effects. Thus, this variable is not discussed further.

Manipulation of partner's locomotions. The participant and the preprogrammed partner took turns in choosing a matrix (from the five different matrices) that would then be used for making cooperative or noncooperative choices. A partner locomoting to high interdependence was programmed to consistently select Matrix 5 (high interdependence condition), and a partner locomoting to low interdependence was programmed to consistently select Matrix 1 (low interdependence condition). More details regarding the procedure follow in the next paragraphs.

Table 3
The Procedure for Making Cooperative and Noncooperative Choices and Selections of Matrices in Which to Make Cooperative and Noncooperative Choices

Trial	Cooperation–noncooperation choice	Selection of matrix	Selector
Set 1		3	Experimenter
Trial 1	A or B		
Trial 2	A or B		
Set 2		1 2 3 4 5	Participant
Trial 3	A or B		
Trial 4	A or B		
Set 3		1 2 3 4 5	Partner
Trial 5	A or B		
Trial 6	A or B		
Set 4		1 2 3 4 5	Participant
Trial 7	A or B		
Trial 8	A or B		
Set 5		1 2 3 4 5	Partner
Trial 9	A or B		
Trial 10	A or B		
Set 6		1 2 3 4 5	Participant
Trial 11	A or B		
Trial 12	A or B		
Set 7		1 2 3 4 5	Partner
Trial 13	A or B		
Trial 14	A or B		
Set 8		1 2 3 4 5	Participant
Trial 15	A or B		
Trial 16	A or B		
Set 9		1 2 3 4 5	Partner
Trial 17	A or B		
Trial 18	A or B		

Note. A = cooperation; B = noncooperation.

Measurement of cooperation and locomotion. The experimental task consisted of nine sets of two choices (for an overview, see Table 3). The first set, involving two trials, was administered prior to the participant's receiving information regarding the other's cooperative behavior or the other's locomotion to low or high interdependence. That is, for these two trials, the experimenter determined the level of interdependence, which was always Matrix 3, representing an average level of interdependence. The second set of two trials (i.e., Trials 3 and 4) were administered after the participant had chosen a matrix (i.e., Matrix 1, 2, 3, 4, or 5) to assess participants' locomotion to varying levels of interdependence. Similarly, prior to the fourth set (Trials 7 and 8), sixth set

[3] The five matrices did not differ in terms of two features that might affect cooperation and locomotions. First, the Grand Mean, or the average of all four possible outcomes, equals zero in all five matrices. Second, we wanted the best possible outcome (50) and worst possible outcome (−50) to be equal for all five matrices, so that the matrices would not differ in terms of risk (which would obtain if there were variations in the worst possible outcome) and opportunity (which would obtain if there were variations in the best possible outcome; cf. Van Lange, 1994). We should also note that fate control should always be equal to or greater than reflexive control in order to match the features of a social dilemma.

(Trials 11 and 12), and eighth set (Trials 15 and 16), we assessed participants' locomotion. (In the analyses of locomotion to be discussed, the scores for locomotion represent the number of the matrix that participants selected.) Prior to the third set (Trials 5 and 6), fifth set (Trials 9 and 10), seventh set (Trials 13 and 14), and ninth set (Trials 17 and 18), participants received information about the partner's locomotion to either low interdependence (i.e., the partner consistently selected Matrix 1) or high interdependence (i.e., the partner consistently selected Matrix 5). Thus, as can be seen in Table 3, the experimenter determined the matrix for the first two trials, after which the participant and the partner took turns in determining the matrix for each subsequent set of two trials. Participants received information regarding the partner's choice (cooperation vs. noncooperation) after each trial and received information regarding the partner's locomotion before each new set of two trials (i.e., before Sets 3, 5, 7, and 9). Also, participants were led to believe that their partners were selected from among those other participants who were present in the session.[4]

Results

Cooperative Behavior

As noted earlier, the social dilemma task involved nine sets of trials, each consisting of two choices (i.e., 18 trials). The first two choices were made prior to receiving information regarding the partner's cooperative behavior or the partner's interdependence choice. The remaining 16 trials were analyzed in four blocks of four trials, so as to analyze cooperative behavior in comparable blocks (i.e., two choices were made in an interdependence situation determined by self, and two choices were made in an interdependence situation determined by the partner). Thus, for each of the four blocks, the number of cooperative choices could vary from zero to four.

The number of the cooperative choices in each block was analyzed in a 3 (social value orientation: prosocial vs. individualistic vs. competitive) by 3 (partner's strategy: cooperative vs. tit for tat vs. noncooperative) by 2 (partner's locomotion: high vs. low interdependence) by 4 (blocks of trials: Blocks 1 through 4) analysis of variance (ANOVA), with partner's strategy and blocks of trials being within-subject variables. First, consistent with Hypothesis 1, this analysis yielded a main effect for partner's strategy, $F(2, 129) = 89.46$, $p < .001$, revealing that a cooperative partner and a tit-for-tat partner elicited greater cooperation than a noncooperative partner (see Table 4). Planned comparisons revealed a significant contrast of cooperative and tit-for-tat partners versus noncooperative partner, $F(1, 129) = 173.47$, $p < .001$. The other orthogonal contrast of cooperative partner versus tit-for-tat partner was also significant, $F(1, 129) = 15.63$, $p < .001$, indicating that a cooperative partner elicited greater cooperation than a tit-for-tat partner.[5]

Second, a main effect of social value orientation, $F(2, 129) = 4.67$, $p < .05$, revealed that prosocials and individualists exhibited greater cooperation than did competitive participants (see Table 4). Planned comparisons revealed a significant contrast of prosocial participants and individualists versus competitors, $F(1, 129) = 9.31$, $p < .01$, and no significant contrast of prosocials versus individualists, $F(1, 129) = 0.03$, *ns*.

Third, the analysis revealed a significant interaction of partner's strategy and social value orientation, $F(4, 258) = 3.95$, $p < .005$. Differences between the mean levels of cooperation by prosocials and individualists (averaging across these two groups) versus competitive participants were quite substantial for a tit-for-tat partner ($M = 2.69$ vs. $M = 1.68$, a mean difference of 1.01), intermediate for a cooperative partner ($M = 2.82$ vs. $M = 2.30$, a mean difference of 0.52), and relatively weak for a noncooperative partner ($M = 0.93$ vs. $M = 0.64$, a mean difference of 0.29; see also Table 4). Planned comparisons revealed (a) a marginal interaction of the competitive versus prosocial–individualistic orientation contrast with the cooperative/tit-for-tat versus noncooperative partner contrast, $F(1, 129) = 3.12$, $p < .10$, and (b) an interaction of the competitive versus prosocial–individualistic orientation contrast with the cooperative-partner versus tit-for-tat partner contrast, $F(1, 129) = 9.34$, $p < .01$. The latter effect indicates that it is especially the tit-for-tat partner, rather than the cooperative partner, who elicits strong differences between prosocial and individ-

Table 4
Mean Number of Cooperative Choices and Mean Interdependence Locomotion as a Function of Own Social Value Orientation and Partner's Strategy

Social value orientation	Partner's strategy: Cooperative	Tit for tat	Noncooperative	*M*
	Cooperative choices			
Prosocial	2.80	2.78	0.87	2.15
Individualistic	2.86	2.54	1.03	2.14
Competitive	2.30	1.68	0.64	1.54
M	2.64	2.46	0.86	1.99
	Interdependence locomotion			
Prosocial	4.18	4.25	2.78	3.74
Individualistic	4.31	4.04	2.90	3.75
Competitive	3.98	3.60	3.11	3.56
M	4.17	4.04	2.89	3.70

[4] It is possible that participants perceived their selections of matrices simply in terms of choosing among different reward structures (i.e., different sets of numerical outcomes) and not necessarily in terms of locomoting to varying levels of interdependence. Theoretically, the matrix selections involve locomotion, given its definition (i.e., goal-directed activity causing change in the interdependence structure underlying an interaction situation . . . ; cf. Lewin, 1935, 1936/1966). We acknowledge that locomotion is a broad concept, which in our view includes the selection of different reward structures, particularly if differences in reward structure represent meaningful differences in interdependence structure (e.g., level of interdependence, the degree to which own and partner's interests conflict, or correspondence of outcomes; Kelley & Thibaut, 1978). We should also acknowledge that the locomotion option might be more strongly experienced as such, when participants, for example, were asked to make a choice of whether to work with the other on different tasks differing in level of interdependence (i.e., no "game" situations).

[5] This finding is inconsistent with previous research, in which locomotion to varying levels of interdependence by either the self or the partner was not possible (e.g., Kuhlman & Marshello, 1975; Oskamp, 1971). As noted earlier, we suggest that the availability of locomotion provides the partner with some power, which may have motivated several individuals to exhibit cooperation in response to a cooperative partner.

ualistic versus competitive participants. Generally, these findings are consistent with Hypothesis 2 (i.e., predicting that differences between prosocial and individualistic vs. competitive participants were overall more pronounced for a tit-for-tat partner and cooperative partners, rather than for noncooperative partners), except that the differences between competitive versus prosocial and individualistic participants were not extremely large for a cooperative partner.[6]

Locomotion to Varying Levels of Interdependence

Locomotions to varying levels of interdependence were assessed by the participant's selections of Matrices 1 to 5. These locomotions were analyzed in a 3 (social value orientation) by 3 (partner's strategy) by 2 (partner's locomotion) by 4 (blocks of trials) ANOVA, with partner's strategy and blocks of trials being within-subject variables. First, this analysis yielded a significant main effect for partner's strategy, $F(2, 128) = 36.02$, $p < .001$, revealing locomotion to greater levels of interdependence with a cooperative partner ($M = 4.17$) and tit-for-tat partner ($M = 4.04$) than with a noncooperative partner ($M = 2.89$). Consistent with Hypothesis 3, planned comparisons revealed a significant contrast of cooperative and tit-for-tat partners versus noncooperative partners, $F(1, 129) = 71.01$, $p < .001$; the other contrast involving cooperative versus tit-for-tat partners was marginal, $F(1, 129) = 3.53$, $p < .10$.

Second, the analysis revealed a significant interaction of social value orientation and partner's strategy, $F(4, 258) = 2.82$, $p < .05$. As can be seen in Table 4, differences among prosocial, individualistic, and competitive participants were small for a cooperative partner (they all moved to high levels of interdependence) and small for a noncooperative partner (they all moved to fairly low levels of interdependence). In contrast, there was a substantial difference between competitors versus individualists and prosocials for a tit-for-tat partner. Competitors moved to significantly lower levels of interdependence than did individualists and prosocial individuals. Consistent with this interpretation, planned comparisons revealed an interaction of the competitive versus individualistic–prosocial orientation contrast with the tit-for-tat versus cooperative–noncooperative partner contrast, $F(1, 129) = 8.69$, $p < .005$. None of the three interactions involving one or both of the other contrasts were significant. These findings support Hypothesis 4, the prediction that, relative to prosocials and individualists, competitors exhibit locomotions to reduced levels of interdependence with a tit-for-tat partner, rather than a cooperative or a noncooperative partner.[7]

Functioning: Participant's Outcomes and Collective Outcomes

As measures of individual and collective functioning, we examined the number of points accumulated by the self (i.e., participant's outcomes) and the number of points accumulated jointly by the self and partner (i.e., collective outcomes).[8] Relevant to participant's outcomes and collective outcomes, we conducted two 3 (social value orientation) by 2 (partner's locomotion) by 3 (partner's strategy) by 4 (blocks of trials) ANOVAs with the latter two variables being within-subject variables. For both participant's outcomes and collective outcomes, we found some evidence of an interaction of social value orientation and partner's strategy, $F(4, 258) = 1.97$, $p < .10$, and $F(4, 258) = 2.41$, $p < .05$, respectively.

Consistent with Hypothesis 5, Table 5 reveals that, relative to competitors' outcomes, prosocials and individualists' outcomes were greater when interacting with a tit-for-tat partner, whereas such differences between competitors versus prosocials and indi-

---

[6] The analysis yielded several other effects, including an interaction of partner's strategy and partner's locomotion, $F(2, 128) = 3.62$, $p < .05$, which revealed that partner's locomotions to high (versus low) interdependence amplify the effects of partner's strategy. Also, we obtained several effects of blocks of trials, indicating that locomotion to high interdependence by noncooperative partners fairly rapidly elicits low levels of cooperation, whereas locomotion to high interdependence by cooperative and tit-for-tat partners gradually elicits greater cooperation. Such effects were less pronounced for partners moving to low interdependence.

[7] The analysis did not reveal a main effect of social value orientation but did reveal an interaction of partner's locomotion and social value orientation, $F(2, 129) = 5.66$, $p < .005$. This effect indicated that prosocials and individualists tended to "match" the partner's locomotion to high interdependence, whereas competitors tended to mismatch the partner's locomotion to high interdependence. Perhaps, competitors felt relatively more ambivalent about partner's locomotions to high interdependence, having insufficient faith in partner's willingness to make cooperative choices. The analysis also revealed two effects involving blocks of trials: a main effect for blocks of trials, $F(3, 127) = 4.51$, $p < .005$, and an interaction of block of trials and partner's strategy, $F(6, 124) = 4.50$, $p < .001$. Generally, these findings revealed that across the four blocks, participants moved to lower levels of interdependence, a decline that was elicited only by a noncooperative partner and not by a cooperative partner or a tit-for-tat partner.

[8] Relevant to the logic that participant's functioning and collective functioning are determined by one's own and one's partner's cooperative choices and locomotion to varying levels of interdependence, we computed links among several variables, thereby collapsing across the four blocks of trials, partner's locomotions, and social value orientation. For cooperative partners, tit-for-tat partners, and noncooperative partners, there were significant correlations between (a) cooperation and locomotion to enhanced interdependence, $rs(135) = .66$, .68, and .41, respectively; (b) cooperation and participant's functioning, $rs(135) = -.76$, .91, and .92, respectively; (c) cooperation and collective functioning, $rs(135) = .83$, .93, and .56, respectively; (d) locomotion to enhanced interdependence and participant's functioning, $rs(135) = -.38$, .65, and $-.69$, respectively; and (e) locomotion to enhanced interdependence and collective functioning, $rs(135) = .66$, .65, and $-.46$, respectively (for all the above correlations, $p < .001$). Subsequent simultaneous regression analyses revealed that both cooperation and locomotion to enhanced interdependence made significant, unique contributions to predicting participant's functioning and collective functioning, for both cooperative partners and noncooperative partners. For tit-for-tat partners, locomotion did not significantly contribute above and beyond cooperation to predicting participant's and collective functioning. Indeed, cooperation and participant's and collective functioning were highly correlated for tit-for-tat partners, because cooperation elicits mutual cooperation and noncooperation elicits mutual noncooperation. Therefore, own cooperation accounts for most of the variance in functioning (in this case, more than 80% of the variance), and hence, there is not much variance left to be accounted for by locomotion to varying levels of interdependence. Taken together, these findings provide support for the claim that cooperation and locomotion account for participant's functioning and collective functioning.

Table 5
Participant Outcomes, Collective Outcomes, Partner's Outcomes, and Equality in Outcomes as a Function of Individuals' Social Value Orientation and Partner's Strategy

Social value orientation	Partner's strategy: Cooperative	Tit for tat	Noncooperative	*M*
	Participant's outcomes			
Prosocial	33.72	13.26	−16.62	10.12
Individualistic	33.80	10.41	−18.60	7.87
Competitive	36.37	2.54	−16.19	7.57
M	33.77	9.97	−17.10	8.88
	Collective outcomes			
Prosocial	37.45	25.46	−24.81	12.70
Individualistic	35.06	20.18	−23.76	10.49
Competitive	30.20	4.07	−30.27	1.34
M	35.09	19.02	−25.76	9.45
	Partner's outcomes			
Prosocial	3.72	12.20	−8.19	2.58
Individualistic	3.27	9.77	−5.16	2.63
Competitive	−6.17	1.53	−14.07	−6.24
M	1.32	9.05	−8.67	0.57
	Equality in outcomes			
Prosocial	30.00	1.06	−8.44	7.54
Individualistic	28.53	0.64	−13.44	5.24
Competitive	42.54	1.01	−2.12	13.81
M	32.45	0.93	−8.43	8.31

Note. Equality in outcomes was calculated by determining the difference between participant's outcomes and partner's outcomes; thus, greater (absolute) means reflect less equality in outcomes.

vidualists were substantially smaller when interacting with a cooperative or noncooperative partner. Consistent with Hypothesis 6, Table 5 reveals that, relative to competitors, collective outcomes obtained by prosocials and individualists were greater when interacting with a tit-for-tat partner, whereas such differences between competitors versus individualists and prosocials were substantially smaller when interacting with a cooperative or noncooperative partner. These conclusions are supported by planned comparisons, revealing an interaction of the competitive versus individualistic–prosocial orientation contrast with the tit-for-tat versus cooperative–noncooperative partner contrast, both for participant's outcomes, $F(1, 129) = 7.49, p < .01$, and for collective outcomes, $F(1, 129) = 6.71, p < .01$. None of the other three interactions involving one or both other contrasts were significant.[9,10]

Discussion

Consistent with our framework for understanding social interaction and the concept of locomotion, the present research reveals strong evidence that partner's strategy and social value orientation exert a strong impact on both cooperation and locomotion to varying levels of interdependence. In the following paragraphs, we consider the major findings and outline several implications.

First, the present findings revealed that, relative to cooperative and tit-for-tat partners, a noncooperative partner elicited less cooperation (in support of Hypothesis 1), and locomotion to lower levels of interdependence (in support of Hypothesis 3). These findings support the more general claim that partner's strategy elicits more "forces" (cf. Lewin, 1936/1966) than simply cooperation versus noncooperation. Disregarding social value orientation, participants moved to high levels of interdependence (approach) when interacting with a cooperative or tit-for-tat partner and moved to low levels of interdependence (avoidance) when interacting with a noncooperative partner. This finding is important, because the extant literature tends to provide only part of the story: Most people cooperate with tit-for-tat partners, somewhat fewer people cooperate with cooperative partners, and virtually nobody cooperates with noncooperative partners. It is plausible that when confronted with noncooperative others, the primary response of most people may be to avoid such others rather than to make

[9] The analyses revealed several other findings for participant's outcomes and collective outcomes, including main effects of partner's strategy, respective $Fs(2, 128) = 905.34$ and 650.57, $p < .001$, and partner's locomotion, respective $Fs(1, 129) = 33.16$ and 11.60, $p < .001$, and an interaction of partner's locomotion by partner's strategy, respective $Fs(2, 128) = 6.42$ and 27.83, $p < .001$. It is noteworthy that, relative to a tit-for-tat partner ($M = 19.02$), a cooperative partner ($M = 35.09$) yielded greater collective outcomes (see Table 5) and that, on average, partner's locomotions to low versus high levels of interdependence amplified the effects of partner's strategy on participant's outcomes and collective outcomes, at least for cooperative partners and tit-for-tat partners. There were no effects of social value orientation, except for a main effect of social value orientation on collective outcomes, $F(2, 129) = 4.26$, $p < .05$. Overall, the collective outcomes obtained by competitors were lower than those of prosocials and individualists (see Table 5). Finally, we obtained several effects involving blocks of trials, for participant's outcomes, partner's outcomes, and collective outcomes. The means associated with the interactions with blocks of trials revealed patterns that were quite similar to those obtained for cooperation.

[10] In a more exploratory vein, we examined partner's outcomes, using the same analyses as for participant's and collective outcomes. A main effect of social value orientation, $F(1, 129) = 3.73$, $p < .05$, revealed that partner's outcomes were lower when interacting with competitors, rather than prosocials or individualists (see Table 5). A main effect for partner's strategy, $F(2, 128) = 65.07$, $p < .001$, and an interaction of partner's strategy and partner's locomotion, $F(2, 258) = 9.35$, $p < .001$, revealed the following pattern. Generally, a tit-for-tat partner yielded the best outcomes ($M = 9.05$), followed by a cooperative partner ($M = 1.32$), and a noncooperative partner yielded the worst outcomes ($M = -8.67$). This effect for tit-for-tat versus cooperative versus noncooperative partners was stronger for partners locomoting to high interdependence (Ms = 12.85 vs. 8.04 vs. −10.82, respectively) than for partners locomoting to low interdependence (Ms = 4.95 vs. −5.91 vs. −6.35, respectively). Given that tit for tat yielded greater outcomes than cooperative or noncooperative partners, and given that tit for tat has received considerable attention as a functional strategy, it is interesting to note that in social dilemmas in which locomotion is possible, tit for tat can do even better if this strategy is accompanied by locomotions to high interdependence rather than low interdependence.

self-centered choices at the expense of others or to become motivated to compete. An interaction-relevant implication of this reasoning is that the resultant pattern of "noncooperative" interaction may be in fact less costly to both individuals than one might infer from the extant literature on cooperation and competition. Indeed, reducing levels of interdependence is an effective means to minimizing the costs (for self and the collective) following from an interdependent other's noncooperative actions.

Second, the present findings revealed that the effect of partner's strategy was moderated by individuals' social value orientation. Relative to prosocials and individualists, competitors exhibited lower levels of cooperation when interacting with a tit-for-tat partner (and to a lesser extent, when interacting with a cooperative partner). In contrast, there were virtually no differences between prosocials and individualists versus competitors when interacting with a noncooperative partner. These findings are consistent with Hypothesis 2 (except that we expected somewhat more substantial differences between prosocials and individualists vs. competitors when paired with a cooperative partner). More important, parallel findings were obtained for locomotions to varying levels of interdependence: Relative to prosocials and individualists, competitors exhibited locomotions to reduced interdependence with a tit-for-tat partner. This finding provides good support for Hypothesis 4. What might be the mechanisms that lead competitors "to move away" from partners pursuing tit for tat?

As suggested earlier, a plausible interpretation is that by virtue of the interactive features of tit for tat, competitors will never be able to accomplish their primary interaction goals (i.e., maximization of relative advantage). Tit for tat is simply unexploitable (except for the very first trial), and thus competitors cannot effectively pursue their primary interaction goals with a tit-for-tat partner (see Table 1). Although this logic is true by definition, a more proximal (and highly complementary) account is that the interaction patterns that competitors elicit from tit for tat (i.e., high levels of mutual defection) influence their locomotions to low levels of interdependence.

We regard these findings to be important for at least two reasons. First, there is a large literature suggesting that tit for tat is the most effective (or one of the most effective) strategies for obtaining cooperation, at least in iterated prisoner's dilemmas. The present research not only supports this claim (i.e., a tit-for-tat partner yielded greater outcomes than did a cooperative partner; see Table 5) but also indicates that, when locomotion is possible, tit for tat may actually have another advantage. It appears to move away those who seek relative advantage, thus minimizing the costs associated with probable noncooperative behavior of competitors. In other words, by virtue of tit for tat's interactive features, an individual using a tit-for-tat strategy takes care of himself or herself in a fairly structural manner by moving competitors away. Assuming that people in real life are often able to move to varying levels of interdependence (e.g., with colleagues and neighbors), tit for tat might actually serve two functions: (a) promoting cooperation among those who are willing to do so (even among "rationally self-interested" individuals), and (b) promoting tendencies of avoidance among those who are unwilling to cooperate (among competitively oriented individuals). These functions tend to serve the long-term outcomes of the individual who adopts tit for tat, as well as the joint outcomes of the two persons involved.

These insights are relevant not only to individuals holding competitive orientations but also to interactions in which one or both individuals are oriented toward enhancing relative advantage over others (e.g., through circumstances that foster competition). For example, these findings may contribute to explaining the discontinuity effect, the finding that intergroup interactions are less cooperative than interindividual interactions in situations characterized by a moderate conflict of interests (for a recent overview, see Insko & Schopler, 1998). If groups are on average more individualistically oriented than are individuals, then tit for tat should elicit high cooperation and locomotion to high interdependence in the other group. However, if groups are on average more competitively oriented, then tit for tat should elicit noncooperation and locomotion to low levels of interdependence.

Second, at the same time, we have seen that cooperative partners actually elicited a fair amount of cooperation, even more cooperation than did tit-for-tat partners. In a parallel manner, cooperative partners yielded greater collective outcomes (albeit distributed unequally; see Table 5) than did tit-for-tat partners. Thus, Axelrod's (1984) assertion that tit for tat and related strategies "might be too competitive for their own good" (Axelrod, 1984, p. 40) may actually be read as "might be too competitive for the collective good," at least when locomotions to varying levels of interdependence are possible. The mere fact that the interdependent other has some power might be sufficient to induce a fair amount of cooperation, even among competitors. One might speculate that in real-life interactions, it may be functional, at least from a collective point of view, to adopt a generous version of tit for tat, in which "bookkeeping" is somewhat less central and communicating trust and benevolence is somewhat more central.

We close by briefly outlining some strengths and limitations of this research. Some limitations derive from the fact that we did not directly compare the effects of locomotion availability (see Footnote 2) and that we addressed only one form of locomotion (i.e., locomotion to varying degrees of interdependence), which was examined in a turn-taking, unilateral manner (i.e., the partner and participant took turns, and that had unilateral control over each locomotion). Indeed, locomotion could also take the form by which both partners simultaneously determine their actual locomotions. We regard this latter issue to be an interesting topic for future research, as it seems plausible that locomotion in real life is often determined in a disjunctive or conjunctive manner (whereby locomotion is determined by the individual who wishes to move to the lowest or highest level of interdependence), rather than in an independent manner. At the same time, the findings provide good support for our framework, which we interpret as good evidence for the validity of the new paradigm for studying locomotion in social dilemmas.

We suggest that the fields of interdependence, cooperation and competition, and social decision making might benefit considerably from attempts to extend the traditional experimental game paradigm to more dynamic paradigms (see also Murnighan, 1991; Nowak, Vallacher, & Lewenstein, 1994). Indeed, the availability of a broader response repertoire may enhance not only the ecological validity of the experimental game paradigm but also our knowledge of the interpersonal dynamics relevant to understanding the functioning of dyads and groups.

It is plausible that functional adaptations to interdependence problems are more easily detected than the extant literature of cooperation and competition suggests, in part because this literature (based on at least 50 years of research) has largely overlooked possibilities for locomotion. Individuals adapt to interdependence situations in multifaceted ways, and one might speculate that social interactions often are quite harmonious, cooperative, and gratifying (although the conflictual ones are likely to be more salient and memorable) because individuals often have the option to locomote. The mere availability of locomotion to varying levels of interdependence might bring about good outcomes for both, and the actual use of locomotion allows individuals to shape one another's behavior more effectively, so that—at the very least—exceptionally poor outcomes for the dyad or group as a whole can often be prevented.

References

Axelrod, R. (1984). *The evolution of cooperation.* New York: Basic Books.

Cartwright, D., & Zander, A. (Eds.). (1953). *Group dynamics.* New York: Harper & Row.

Dawes, R. M., & Orbell, J. M. (1992, July). *Optimism about others as a cooperators' comparative advantage.* Paper presented at the Fifth International Conference on Social Dilemmas, Bielefeld, Germany.

Insko, C. A., & Schopler, J. (1998). Differential distrust of groups and individuals. In C. Sedikides, J. Schopler, & C. A. Insko (Eds.), *Intergroup cognition and intergroup behavior* (pp. 75–107). Mahwah, NJ: Erlbaum.

Kelley, H. H. (1984). The theoretical description of interdependence by means of transition lists. *Journal of Personality and Social Psychology, 47,* 956–982.

Kelley, H. H. (1997). Expanding the analysis of social orientations by reference to the sequential–temporal structure of situations. *European Journal of Social Psychology, 27,* 373–404.

Kelley, H. H., & Stahelski, A. J. (1970). Social interaction basis of cooperators' and competitors' beliefs about others. *Journal of Personality and Social Psychology, 16,* 66–91.

Kelley, H. H., & Thibaut, J. W. (1978). *Interpersonal relations: A theory of interdependence.* New York: Wiley.

Kerr, N. L. (in press). Anonymity and social control in social dilemmas. In M. Foddy, M. Smithson, S. Schneider, & M. Hogg (Eds.), *Resolving social dilemmas: Dynamic, structural, and intergroup aspects.* Philadelphia: Psychology Press.

Komorita, S. S., Hilty, J. A., & Parks, C. D. (1991). Reciprocity and cooperation in social dilemmas. *Journal of Conflict Resolution, 48,* 494–518.

Komorita, S. S., & Parks, C. D. (1995). Interpersonal relations: Mixed-motive interaction. *Annual Review of Psychology, 46,* 183–207.

Kuhlman, D. M., & Marshello, A. (1975). Individual differences in game motivation as moderators of preprogrammed strategic effects in prisoner's dilemma. *Journal of Personality and Social Psychology, 32,* 922–931.

Lewin, K. (1935). *A dynamic theory of personality.* New York: McGraw-Hill.

Lewin, K. (1966). *Principles of topological psychology* (F. Heider & G. Heider, Trans.). New York: McGraw-Hill. (Original work published 1936)

McClintock, C. G., & Allison, S. T. (1989). Social value orientation and helping behavior. *Journal of Applied Social Psychology, 19,* 353–362.

McClintock, C. G., & Liebrand, W. B. G. (1988). The role of interdependence structure, individual value orientation and other's strategy in social decision making: A transformational analysis. *Journal of Personality and Social Psychology, 55,* 396–409.

Messick, D. M., & McClintock, C. G. (1968). Motivational bases of choice in experimental games. *Journal of Experimental Social Psychology, 4,* 1–25.

Messick, D. M., Wilke, H. A. M., Brewer, M. B., Kramer, R. M., Zemke, P. E., & Lui, L. (1983). Individual adaptations and structural change as solutions to social dilemmas. *Journal of Personality and Social Psychology, 44,* 294–309.

Miller, D. T., & Holmes, J. G. (1975). The role of situational restrictiveness and self-fulfilling prophecies: A theoretical and empirical extension of Kelley and Stahelski's triangle hypothesis. *Journal of Personality and Social Psychology, 31,* 661–673.

Murnighan, J. K. (1991). *The dynamics of bargaining games.* Englewood Cliffs, NJ: Prentice Hall.

Nemeth, C. (1972). A critical analysis of research utilizing the prisoner's dilemma paradigm for the study of bargaining. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 6, pp. 203–234). New York: Academic Press.

Nowak, A., Vallacher, R. R., & Lewenstein, M. (1994). Toward a dynamical social psychology. In R. Vallacher & A. Nowak (Eds.), *Dynamical systems in social psychology* (pp. 279–293). San Diego, CA: Academic Press.

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning.* Urbana: University of Illinois Press.

Oskamp, S. (1971). Effects of programmed strategies on cooperation in the prisoner's dilemma and other mixed-motive games. *Journal of Conflict Resolution, 15,* 225–259.

Pruitt, D. G., & Kimmel, M. (1977). Twenty years of experimental gaming: Critique, synthesis, and suggestions for the future. *Annual Review of Psychology, 28,* 363–392.

Samuelson, C. D., Messick, D. M., Rutte, C. G., & Wilke, H. A. M. (1984). Individual and structural solutions to resource dilemmas in two cultures. *Journal of Personality and Social Psychology, 47,* 94–104.

Sattler, D. N., & Kerr, N. L. (1991). Might versus morality explored: Motivational and cognitive bases for social motives. *Journal of Personality and Social Psychology, 60,* 756–765.

Schopler, J., & Insko, C. A. (1992). The discontinuity effect in interpersonal and intergroup relations: Generality and mediation. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 3, pp. 121–151). Chichester, England: Wiley.

Snyder, M., & Ickes, W. (1985). Personality and social behavior. In G. Lindzey & E. Aronson (Eds.), *Handbook of social psychology* (pp. 883–947). New York: Random House.

Thibaut, J. W., & Kelley, H. H. (1959). *The social psychology of groups.* New York: Wiley.

Van Lange, P. A. M. (1994). Toward more locomotion in experimental games. In U. Schulz, W. Albers, & U. Mueller (Eds.), *Social dilemmas and cooperation* (pp. 25–43). New York: Springer.

Van Lange, P. A. M. (1997). Movement in social orientations: A commentary on Kelley. *European Journal of Social Psychology, 27,* 423–432.

Van Lange, P. A. M. (1999). The pursuit of joint outcomes and equality in outcomes: The integrative model of social value orientation. *Journal of Personality and Social Psychology, 77,* 337–349.

Van Lange, P. A. M., Agnew, C. R., Harinck, F., & Steemers, G. (1997). From game theory to real life: How social value orientation affects willingness to sacrifice in ongoing close relationships. *Journal of Personality and Social Psychology, 73,* 1330–1344.

Van Lange, P. A. M., & Kuhlman, D. M. (1994). Social value orientations and impressions of a partner's honesty and intelligence: A test of the might versus morality effect. *Journal of Personality and Social Psychology, 67,* 126–141.

Van Lange, P. A. M., Otten, W., De Bruin, E. N. M., & Joireman, J. A.

(1997). Development of prosocial, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology, 73,* 733–746.

Van Vugt, M. (1997). Concerns about the privatization of public goods: A social dilemma analysis. *Social Psychology Quarterly, 60,* 355–367.

Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal domain. *Journal of Personality and Social Psychology, 37,* 395–412.

Yamagishi, T. (1988). Exit from the group as an individualistic solution to the free-rider problem in the United States and Japan. *Journal of Experimental Social Psychology, 50,* 67–73.

Yamagishi, T., Hayashi, N., & Jin, N. (1994). Prisoner's dilemma networks: Selection strategy versus action strategy. In U. Schulz, W. Albers, & U. Mueller (Eds.), *Social dilemmas and cooperation* (pp. 233–250). New York: Springer.

Received October 19, 1998
Revision received April 27, 1999
Accepted April 27, 1999 ■